POLICY ANALYSIS FOR THE PUBLIC AND PRIVATE SECTORS
M.CUBED

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Agenda Item 4a

DATE: April 17, 2015
TO: City of Santa Cruz WSAC
FR: David Mitchell
RE: Low and high interim demand forecasts

At its February meeting, the WSAC directed the Technical Team to develop low and high interim demands that bound the probable range of future treated water service demand through 2035. This memorandum describes the adjustments made to the interim demand forecast presented at the February WSAC meeting to produce the low and high forecasts.

Price and Income Adjustment Range

The Feb WSAC interim demand forecast used price and income elasticities to adjust the 2010 UWMP demand forecast for future price and income effects on demand. It was noted during the February WSAC meeting that there is uncertainty in the elasticity parameters and that the actual underlying values for the Santa Cruz region could be higher or lower than what was selected. To reflect this uncertainty we looked at the 95% statistical confidence intervals for price and income elasticities from recent studies of urban water demand by Western Policy Research (2014), Chesnutt (forthcoming), Mitchell, et al. (2013), and Mitchell (forthcoming). These intervals have an average range of +/- 20% from the estimated parameter. We used this average percentage range to adjust the price and income elasticities for the low and high demand forecasts as shown in Tables 1 and 2.

Table 1. Price Elasticity Assumptions for Interim Low and High Demand Forecasts

Customer Category	Feb WSAC Value	Interim Low Demand Elasticity is 20% larger in magnitude	Interim High Demand Elasticity is 20% smaller in magnitude
Single Family Summer	-0.30	-0.36	-0.24
Single Family Winter	-0.15	-0.18	-0.12
Multi Family Summer	-0.15	-0.18	-0.12
Multi Family Winter	-0.075	-0.09	-0.06
Non Residential Summer	-0.10	-0.12	-0.08
Non Residential Winter	-0.10	-0.12	-0.08

Table 2. Income Elasticity Assumptions for Interim Low and High Demand Forecasts

Customer Category	Feb WSAC Value	Interim Low Demand Elasticity is 20% smaller in magnitude	Interim High Demand Elasticity is 20% larger in magnitude
Single Family	0.25	0.20	0.30
Multi Family	0.05	0.04	0.06

Income adjustments in the Feb WSAC forecast were based on the forecast of per capita income growth prepared by Caltrans for Santa Cruz County. As part of this update, we compared historical rates of median household income growth reflected in decennial census data to the Caltrans forecasted rates of growth and found the Caltrans rates to be significantly higher. Partly this may be due to the coincidence of the 2010 Census with the Great Recession which had a significant impact on median household income. To account for the possibility of lower than forecast income growth, the low forecast assumes income growth of half the rate forecast by Caltrans. Thus the low forecast assumes both a lower income response and slower income growth than the high forecast.

Table 3 shows the combined price-income effect on demand for the Feb WSAC, low, and high interim forecasts.

Table 3. Combined Price-Income Percentage Adjustment to Demand for Feb WSAC, Low, and High Interim Demand Forecasts

	Single Family			Multi Family			Non Residential		
Year	Feb WSAC	Low	High	Feb WSAC	Low	High	Feb WSAC	Low	High
2015	-0.9%	-1.6%	-0.4%	-0.6%	-0.9%	-0.5%	-0.7%	-0.8%	-0.5%
2020	-7.1%	-11.5%	-4.2%	-4.5%	-6.0%	-4.2%	-4.5%	-5.4%	-3.6%
2025	-7.9%	-14.6%	-3.8%	-5.6%	-7.8%	-4.0%	-6.0%	-7.2%	-4.8%
2030	-9.4%	-18.3%	-4.0%	-7.0%	-9.8%	-4.9%	-7.6%	-9.1%	-6.1%
2035	-11.3%	-22.5%	-4.5%	-8.6%	-12.1%	-6.0%	-9.4%	-11.2%	-7.5%

Personal Income vs Wage and Salary Income in Forecast

The income adjustments for the low and high interim forecasts, like the Feb WSAC forecast, are based on projected rates of growth in real per capita income for Santa Cruz County, as forecast by Caltrans. At the February WSAC meeting it was suggested we consider using growth in real wage and salary earnings instead. We have not chosen to do this for three reasons. First, and most importantly, the income elasticities we are using are based on empirical studies that used real personal income, not wage and salary earnings, to measure the effect of changes in household income on water use. Given the elasticities we are using, the appropriate income measure is real personal income, not wage and salary earnings. Second, wage and salary earnings, while the dominant source of income for most households, is not the only source of income. Households also receive transfer payments from the government and pensions, and income from assets and property. For lower income and older households in particular, one or more of these latter sources may be the primary source of income. If the various income sources are growing at different rates, which is likely, using just one source – in this case wage and salary

earnings – to measure the rate of change in overall household income will produce biased estimates. Third, the Caltrans wage and salary forecast is a forecast of wage and salary income per *worker*, not per *resident*. The distinction is important because not all who work in Santa Cruz County are residents and not all who live in Santa Cruz County also work there. Wage income for those working in Santa Cruz could very well be growing at a different rate than wage income for those who live in Santa Cruz. Since we are trying to forecast changes in resident household income, the wage and salary earnings per worker forecast would seem to be measuring the wrong thing for our purposes.

In-City Commercial Growth Range

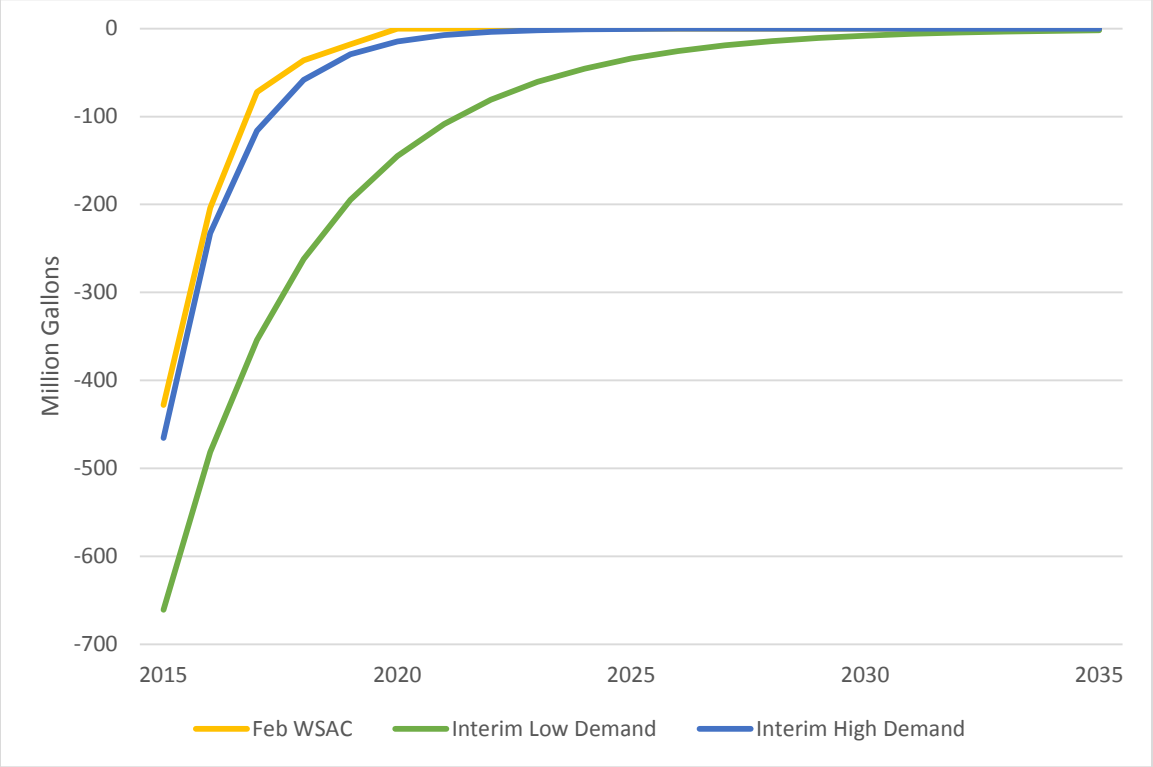
The Feb WSAC interim demand forecast reduced the 2010 UWMP's forecast of new growth in in-city commercial water use from 6 to 3 mg/yr/yr. For the low interim demand forecast we use the adjusted growth rate of 3 mg/yr/yr. For the high demand forecast we use the growth assumption from the UWMP of 6 mg/yr/yr.

Drought Recovery Range

In the Feb WSAC interim demand forecast we assumed demands would rebound from the current drought over a 3 to 5 year period. We assumed that non-residential demands would recover in 3 years while residential demands would recover in 5 years. For the high demand forecast we retain these assumptions. For the low demand forecast we assume recovery of demands other than for municipal irrigation and golf courses is more gradual. While the bulk of the adjustment occurs by 2020, demands don't fully recover until about 2030 in the low demand forecast. The drought adjustments under the Feb WSAC, low, and high interim demand forecasts are illustrated in Figure 1.[1]

[1] Note that there are small differences in the annual adjustments between the Feb WSAC and high interim forecasts because we changed the way the adjustments are modeled. In the Feb WSAC forecast the adjustments were modeled as annual discrete increments. In the low and high forecasts we use a continuous exponential decay process to represent the adjustment.

Figure 1. Drought Recovery Adjustment to Demand for Feb WSAC, Low, and High Interim Demand Forecasts



Updated Plumbing Code and Program A Water Savings

The estimated plumbing code and Program A water savings are scaled-down estimates produced by the DSS model seeded with the 2010 UWMP demand forecast. The estimates are scaled down to reflect lower base demands than the DSS model assumed because of the price/income and in-city growth adjustments we make. Because the magnitude of these adjustments in the low and high interim forecasts differ from the Feb WSAC interim forecast, the scaled down plumbing code and Program A savings also differ. The estimates of plumbing code and Program A savings used in the Feb WSAC, low, and high interim forecasts are shown in Table 4. It may seem counterintuitive that the adjustment is smaller in magnitude for the low than the high demand forecasts, but this occurs because under the high demand forecast base demands are higher and potential savings are greater.

Table 4. Plumbing Code and Program A Savings Adjustments to Feb WSAC, Low, and High Interim

Year	Feb WSAC (Mil Gal)	Low Interim (Mil Gal)	High Interim (Mil Gal)
2015	-80	-77	-80
2020	-191	-185	-194
2025	-287	-284	-293
2030	-348	-346	-356
2035	-380	-377	-389

UCSC Demands

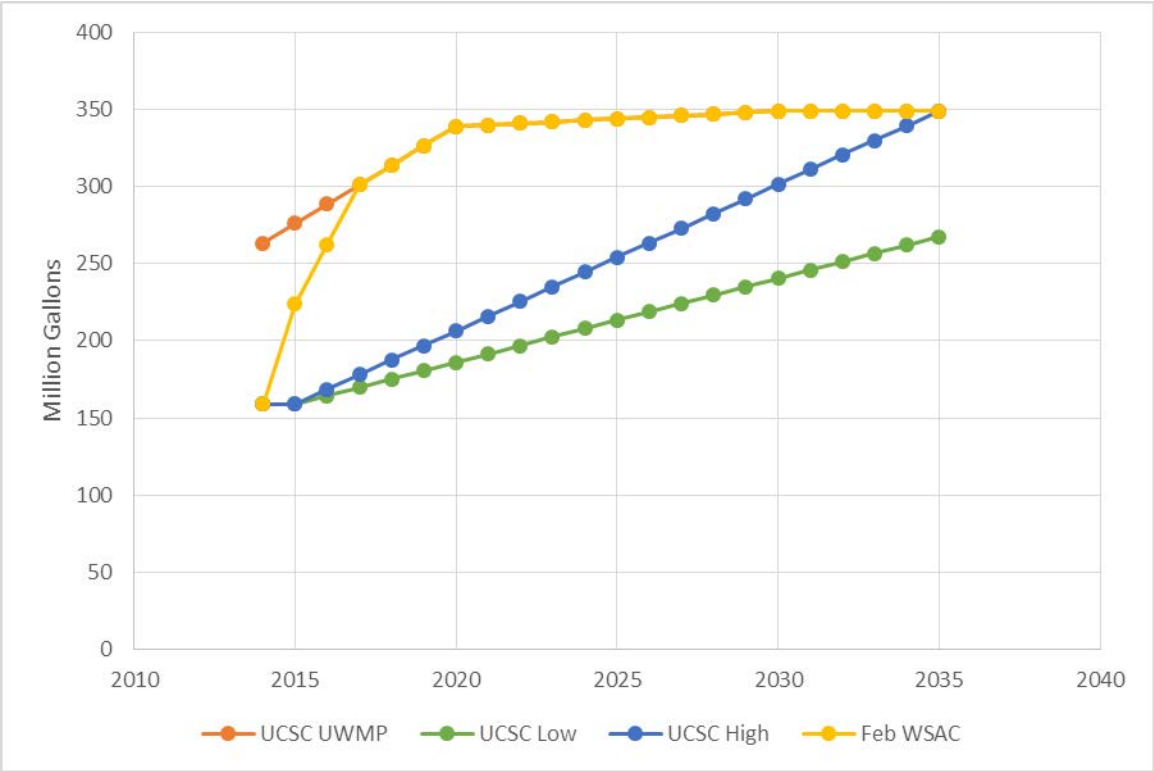
In its response to the City's information request on future demand growth, the University reconfirmed its build out forecast of 349 mgy, but acknowledged the pace of growth would be slower than assumed in the LRDP and in particular that it would not reach projected demand for 2020. The low and high interim demand forecasts each assume a build out demand of 349 mgy. The high demand forecast assumes build out by 2035. The low demand forecast assumes build out by 2050. Both forecasts assume demands in 2015 will be the same as 2014. Demand is linearly interpolated for the intervening years, as shown in Figure 2. Table 5 shows the Feb WSAC and low and high demand forecasts. The baseline interim forecast uses the midpoint between the new low and high UCSC interim forecasts.

The updated baseline interim demand forecast is very close to forecasting future University demand based on projected student enrollment and per capita water use rates. The enrollment-based approach yields a 2035 demand of 304 mgy compared to the updated baseline interim forecast of 308 mgy.

Table 5. UCSC Feb WSAC, Low, and High Interim Demand Forecasts

Year	Feb WSAC Interim Demand (Mil Gal)	Low Interim Demand (Mil Gal)	High Interim Demand (Mil Gal)	Baseline Interim Demand (Mil Gal)
2015	224	159	159	159
2020	339	186	207	196
2025	344	213	254	234
2030	349	240	302	271
2035	349	268	349	308

Figure 2. UCSC Low, High, and Feb WSAC Interim Forecasts



Summary of Feb WSAC, Low, and High Interim Demand Forecasts

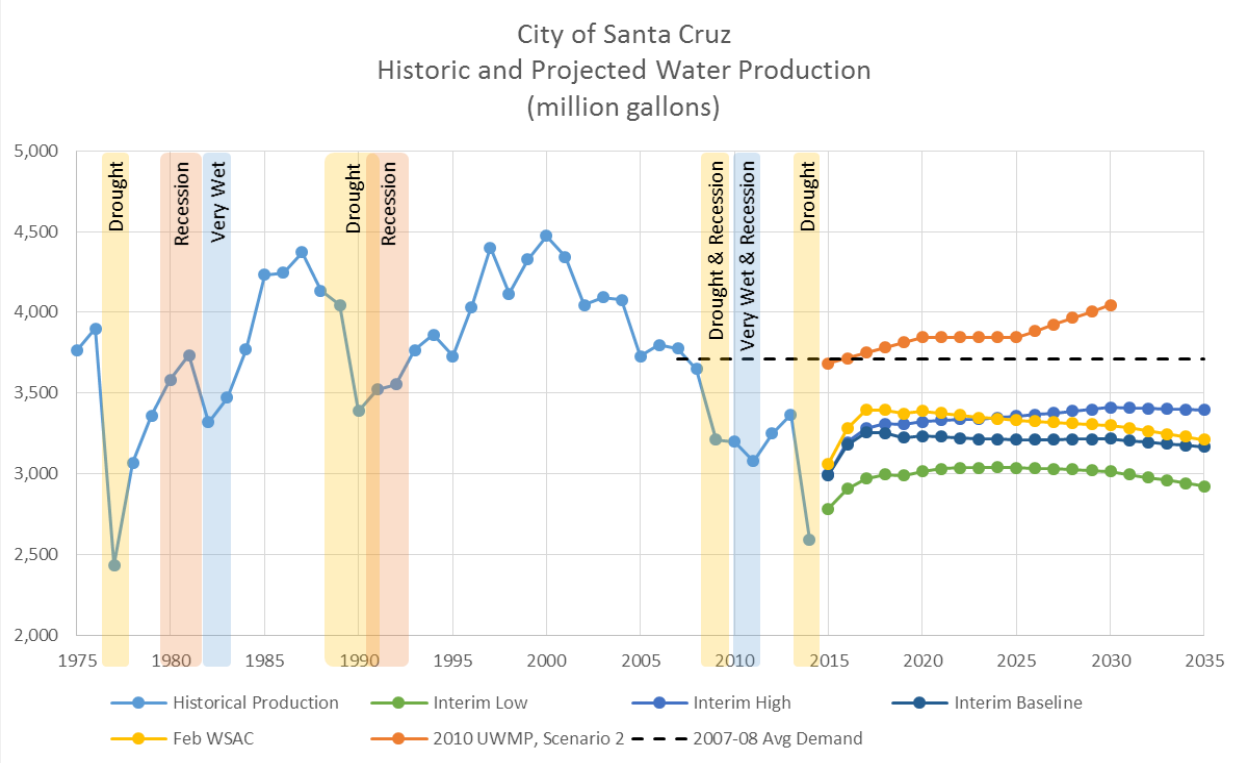
The Feb WSAC, low, high and baseline interim demand forecasts are summarized in Table 6 and Figure 3. In Table 6, demands are rounded to the nearest 100 million gallons.

Table 6. Feb WSAC, Low, and High Interim Total Treated Water Service Demand Forecasts

Year	Feb WSAC Interim Demand (Mil Gal)	Low Interim Demand (Mil Gal)	High Interim Demand (Mil Gal)	Baseline Interim Demand (Mil Gal)
2015	3100	2800	3000	3000
2020	3400	3000	3300	3200
2025	3300	3000	3400	3200
2030	3300	3000	3400	3200
2035	3200	2900	3400	3200

Rounded to nearest 100 million gallons.

Figure 3. Interim Demand Forecasts



Water Use Benchmarks

At the February WSAC meeting a request was made to benchmark the interim demand forecast against historical water use rates. In the figures below we present three water use benchmarks:

1. Gross Per Capita Water Use – total treated water production in gallons per day divided by service area population.

2. Residential Per Capita Water Use – total deliveries to single family and multifamily services in gallons per day divided by service area population less UCSC resident population.

3. Non-residential water use per job – total deliveries to non-residential services in gallons per day divided by the service area's pro-rated share of county employment based on population.

We make the following observations:

- Forecasted gross per capita water use ranges between 79 and 84 gallons for the low forecast and between 85 and 93 gallons for the high forecast. For the period 2004-2008 it averaged 116 gallons. For the period 2009-2013 it averaged 95 gallons.

- Forecasted residential per capita water use ranges between 47 and 54 gallons for the low forecast and between 55 and 60 gallons for the high forecast. For the period 2004-2008 it averaged 75 gallons. For the period 2009-2013 it averaged 62 gallons.

- Forecasted non-residential water use per job ranges between 78 and 85 gallons for the low forecast and between 81 and 95 gallons for the high forecast. For the period 2004-2008 it averaged 105 gallons. For the period 2009-2013 it averaged 91 gallons.

Figure 4

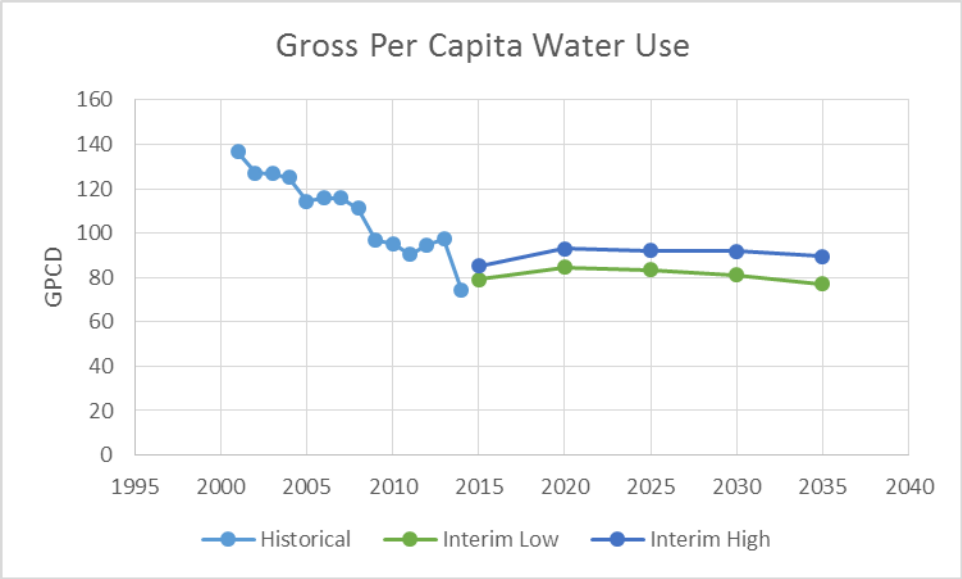


Figure 5

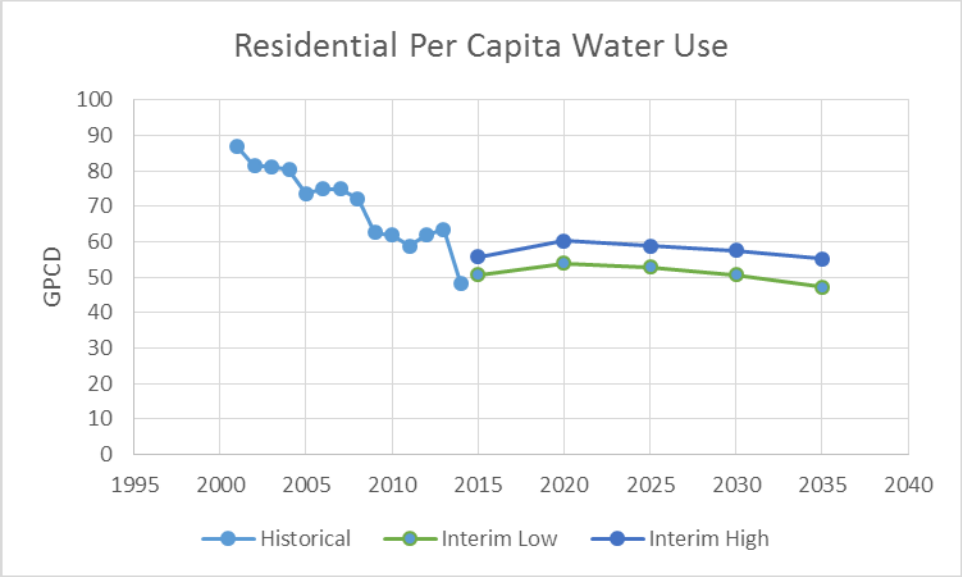
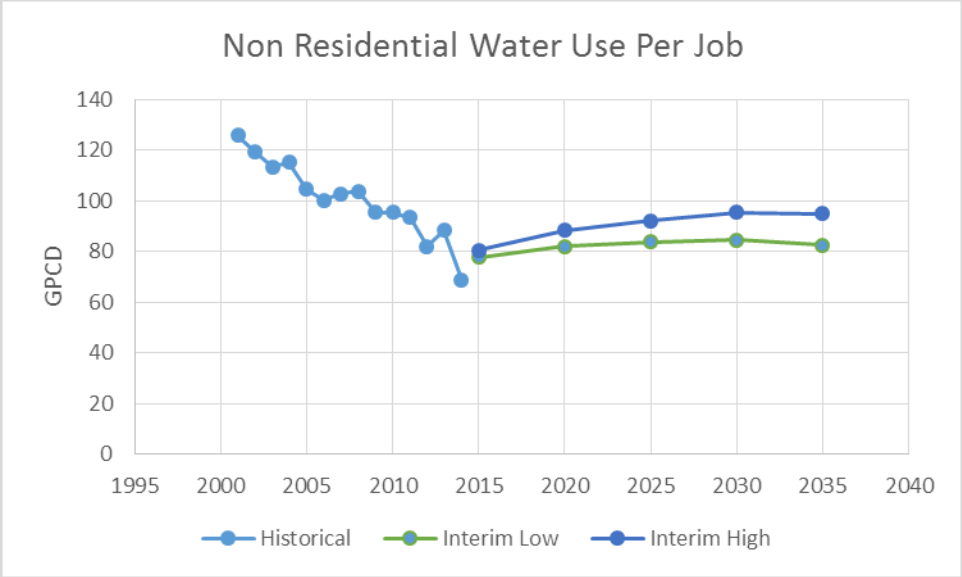


Figure 6


Non Residential Water Use Per Job
GPCD
140
120
100
80
60
40
20
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Historical
Interim Low
Interim High

References

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Mitchell, D., Watson, A., and Cheong, W., Contra Costa Water District Future Water Supply Study Update: Demands Technical Memorandum, M.Cubed and RMC Water and Environment, November 2013.

Mitchell, D., California Water Service Company's 2017 Test Year District Sales Forecasts: 2015 General Rate Case, M.Cubed, (forthcoming).

Western Policy Research and Maddaus Water Management, Bay Area Water Supply & Conservation Agency Regional Water Demand and Conservation Projections, Final Report, September 2014.